

Claims

- [c1] 1. An analog computer controlled by an auxiliary digital computer for solving Laplacian partial differential equations by the finite difference method comprised of:
- a plurality of digital programmable switching devices having similar parasitic resistances that are connected to each other in a resistive grid having nodal points;
- one or more analog-to-digital converters connectable to selected nodal points, whereby nodal point voltages may be read out via said auxiliary digital computer; and
- externally accessible pins connected to said digital programmable switching devices, whereby digital-to-analog converters can inject voltages corresponding to Dirichlet boundary conditions via said auxiliary digital computer.
- [c2] 2. The analog computer of claim 1 wherein said digital programmable devices are field programmable interconnect devices, in which the terminal-to-terminal connection relationship is arbitrarily definable under program control.
- [c3] 3. An expanded version of the analog computer of claim 2, wherein a large Laplacian partial differential equation problem to be solved is partitioned in sub-problems, each sub-problem being large enough to implement in the claim 2 equation solver, where a solution to the total problem is effected by using a combination of known Dirichlet boundary conditions corresponding to those in the problem specification and unknown Dirichlet boundary conditions that are supplied through partial computational results directly measured at the appropriate nodal points generated in one or more of the sub-problems, and where the solution of the large problem is completed by iteratively solving sub-problems in rotation, which produces eventual convergence.
- [c4] 4. An expanded analog computer controlled by an auxiliary digital computer for solving Laplacian partial differential equations by the finite difference method comprised of:
- a network of two or more field programmable interconnect device (FPID) sections, each FPID section comprised of an array of FPID devices having similar

parasitic resistances that are connected to each other in a resistive grid having nodal points;

external terminal pins connected to each FPID section, whereby digital-to-analog converters can inject voltages corresponding to Dirichlet boundary conditions via said auxiliary digital computer; and

one or more analog-to-digital converters connectable to selected nodal points of any FPID section, whereby nodal point voltages may be read out via said auxiliary digital computer.

- [c5] 5.A method of solving Poisson partial differential equation problems by the finite difference method using a programmable resistive grid comprised of the essentially identical parasitic resistances of field programmable interconnect devices (FPIDs), said programmable resistive grid having externally accessible pins and grid nodal points, the method comprised of:
- impressing voltages onto said externally accessible pins corresponding to Dirichlet boundary conditions and
- measuring the voltages at grid nodal points.